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LASSA FEVER IMMUNE PLASMA

ANNUAL REPORT

John D. Frame,

July 31, 1988

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During the year 358 units of Lassa Fever Immune Plasma were obtained by plasmapheresis at the Curran Lutheran Hospital (CLH) and Phebe Hospital (PH). Of these, 180 were forwarded to the US Army Medical Research Institute of Infectious Diseases (USAMRIID). Most will likely be used there in the production of Lassa Fever Immune Globulin (LFIG). LFIG will be a relatively stable product of known potency for the treatment of LF.

Attempts to diagnose LF continued. Virus isolation was not done regularly at USAMRIID because of the pressure of other research. The serological diagnosis of LF is made by seroconversion or a four-fold rise in the titer of indirect fluorescent antibody (IFA). Possible LF (PLF) is diagnosed by an IFA titer of 1:64 in a patient with an illness compatible with LF. At CLH 32 cases of LF and 11 of PLF were found; there were 27 and 25 cases, respectively, at PH. A case of PLF at Kolahun Hospital in the Liberian Northwest and one of LF at ELWA hospital near the coast were the first active

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19. cases to be identified at these sites.

A clinical association of LF with icteric hepatitis, and the impression that LF at PH has been more severe and more contagious recently than in the past deserve further virological study. Keywords: Lasso Virus, Immunoth[illegible]

Dr. Peter Jahrling of USAMRIID visited research sites and conferred with those engaged in Lassa fever research there.

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Summary

Near the end of the third year of investigation of Lassa fever (LF) in Liberia under contract DAMD17-85-C-5189, Dr. Peter Jahrling of USAMRIID visited the research sites. He discussed the program with most participants including Dr. Aloysius Hanson at the Liberian Institute for Biomedical Research (LIBR), Dr. Mark Monson of the Curran Lutheran Hospital (CLH) in Zorzor, Dr. Andrew Cole at the hospital in Kolahun, ans Dr. Walter Gwenigale and his staff at Phebe Hospital (PH). He also made brief visits to medical work in Foya and Ganta, both areas of high Lassa virus activity. The purpose of the visit was to evaluate the present status of work in Liberia, and the potentials for further research there.

The Clincal Investigator, Mr. J. E. Yalley-Ogunro, was engaged in visits to the field stations at CLH and PH for plasmapheresis, in testing patients for indirect fluorescent antibodies (IFA), and in experiments with the enzyme-linked immunosorbent assay, working to perfect it as a means for the early diagnosis of LF in the field.

Plasmapheresis yielded 358 plasma units, of which 180 were forwarded to USAMRIID. They are to be tested there for the concentratrion of neutralizing antibodies by the Log Neutralization Index (LNI). Most will be added to supplies sent earlier to be converted to LF Immune Globulin, a potential means of treatment for LF patients.

The diagnosis of LF among febrile patients was hampered by the lack of virus isolation. As in the past, the serological diagnosis of LF was made by seroconversion or a four-fold rise in indirect fluorescent antibody (IFA) titers in serial sera. Possible LF (PLF) was reported if the IFA titer was 1:64 or higher. Among the 305 patients tested at CLH from May, 1986 to mid-June, 1988, 32 were found to have LF and 11, PLF. At PH in the same period, of 377 patients 27 were diagnosed as LF and 25, PLF. Because virus isolation was not done, no comparison was made with rates of former years when virological diagnosis was performed.

Clinical impressions suggested the association of LF with icteric hepatitis in several instances at CLH, and possible increased virulence and contagiousness of LF at PH. It is suggested that attempts to characterize the infecting strains in these cases may increase our knowledge of the biology of Lassa virus.

A case of PLF was diagnosed in Kolahun, northwest Liberia, and one of LF at ELWA hospital, near the coast, each for the first time in its location. Serosurveys had earlier demonstrated LV activity in both areas.

Though immunotherapy with LFIP continued at CLH and PH, no attempts to evaluate its efficacy were made. Without virus isolation for diagnosis and without the testing of the potency of LFIP units by neutralization tests, evaluation of treatment was not possible.

Foreword

For the protection of human subjects the investigators have adhered to policies of applicable Federal Law 45CFR46.

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Introduction

The major event of the third year of the current investigation of Lassa fever (LF) in Liberia was the site visit by Dr. Peter Jahrling, virologist at the US Army Medical Research Institute of Infectious Disease (USAMRIID) and technical adviser to the study. In addition, LF cases were identified at two sites where previously only serological evidence of Lassa virus (LV) activity had been found, and preliminary results of several cases suggested that Lassa virus (LV) infection may at times be associated with the syndrome of icteric hepatitis.

The history of LF in Liberia has been reviewed in the Annual Summary Report, July 31, 1986 (1). An outbreak at the Curran Lutheran Hospital (CLH) in 1972 first demonstrated the presence of LF in that country (2). Subsequent investigations demonstrated high prevalences of seropositive staff members in many Liberian hospitals (3, 4), most notably in northern Liberia, and among village populations near them (5). Field stations for LF research were established in CLH in Lofa County, Phebe hospital (PH), Bong County, and most recently, at Kolahun Hospital (KH), Lofa County.

Lassa fever research in Liberia is performed under the guidance and with the logistical support of USAMRIID, Fort Detrick, Frederick, MD. USAMRIID supplies antigenic materials for testing by the indirect fluorescent antibody (IFA) technique, and recently, by enzyme-linked immunosorbent assay (ELISA) (6). USAMRIID also performs virus isolation on selected patient sera.

In accordance with criteria based on the investigations of Dr. Peter Jahrling at USAMRIID (7), plasma donors are selected from among convalescents from LF about six months after their acute illness, when titers of protective antibody, measured by the Log Neutralization Index (LNI) are likely to be high enough to warrant their use in treatment of LF cases, and in the preparation of Lassa Fever Immune Globulin.

Therapeutic trials of Lassa Fever Immune Plasma (LFIP) in Liberia have not been conclusive. It was hoped that changes in viremia would be a better measure than clinical recovery for the determination of efficacy of immunotherapy. Unfortunately, it has not been possible to maintain specimens at a low enough temperature to make viremia titers reliable. Furthermore, up to the present the laboratory diagnosis of LF is made retrospectively, and the use of LFIP has proved wasteful when administered on the basis of clinical diagnosis. The use of the ELISA for detection of LV antigen is being tested as a means of permitting rapid diagnosis of LF in the field. Preliminary studies show promise, but further refinement of the test is needed to permit its reliable use in Liberian hospitals.

Activities

Peter Jahrling, Ph. D., Chief, Department of Pathogenesis and Immunology at USAMRIID, visited the sites of LF research in Liberia.

At Robertsfield he discussed the scope of the work with Dr. Aloysius Hanson of the LIBR, who had delayed his departure to the World Health Assembly in Geneva in order to meet him. He reviewed the plasmapheresis procedures at CLH, and visited the laboratories there and at PH. His trip to Kolahun was to an area that is proposed as the site of future LV vaccine field studies. At Foya he visited the Free Pentecostal Mission Clinic whose staff in the past has consistently demonstrated the highest prevalence of LV antibodies of any hospital or clinic in Liberia. It is at Foya that the prevalence of hearing defects from LV infection appears to be highest of all our study areas. Foya was the site of some of our early work with LF, but is too small and too isolated for major research.

Dr. Jahrling also met with the staffs of PH, and with the medical and nursing staffs of the G. W. Harley Memorial Hospital and the Rehabilitation Center at Ganta, in Nimba County. Both these institutions are increasingly sending suspected LF patients to PH, about 45 miles away on a paved road, for definitive diagnosis and treatment for LF, and are likely to become increasingly important as sites for the study of clinical LF.

Mr. J. E. Yalley-Ogunro, Field Investigator, has traveled repeatedly to the field stations to conduct plasmapheresis, and to gather patient and other serum specimens that have accumulated. He has reviewed the work of laboratory technicians, and has started to instruct them in the ELISA technique.

In his laboratory at the Liberian Institute for Biomedical Research (LIBR) he has continued experiments with the ELISA, and has tested sera for the presence of IFA as in the past.

Andrew Cole M.D., Clinical Investigator, has begun to attempt the laboratory diagnosis of LF cases, now that a solar-energy powered refrigerator-freezer has been supplied him, instructing his staff to obtain paired sera from febrile patients in his small hospital at Kolahun. His objective is to determine the incidence of LF in rural communities and to this end he instructs his village health workers in the diagnosis of LF. His work will be of particular importance in the establishing of baseline incidence statistics for field trials of a LV vaccine, when they are undertaken.

Mark H. Monson, M.D. continues the management of LF patients at CLH. His hospital records maintained under the difficult conditions prevailing in a small rural African hospital continue to provide clinical information important in the elucidation of the clinical spectrum of LF. His practical experience with LF and with the African milieu contributes significantly in the planning of further research.

The Director of the Phebe Hospital Medical Center, Walter Gwenigale, M.D., has appointed Yvonne Takyi, M.D., as head of the LF program there with the expectation that coordination between clinical and laboratory activities will be strengthened. Stronger

organization of the staff was in part a response to what appears to be an increasing incidence and increasing severity of LF at PH.

The Principal Investigator, John D. Frame, M.D. visited the sites of present and potential LF research in Liberia in October, 1987 and again in April, 1988. He coordinates the research program with Dr. Aloysius Hanson, Director of the LIBR. In Liberia he conducts conferences with hospital staffs, most regularly at CLH and PH. Much of the April 1988 site visit with Dr. Jahrling was taken up with the discussion of directions of future LF research in Liberia.

Plasmapheresis

During the year 358 units of LFIP were obtained from convalescents from LF. Of these, 180 units were forwarded to USAMRIID; most will be used in the production of LF Immune Globulin, important for contemplated treatment trials. The roster of donors the and list of the plasma units are found in Table 1, in the Appendix. Results of testing of neutralizing antibody levels of plasma units obtained this year are not yet at hand.

Veteran plasma donors are matter-of-fact about the Field Investigator's visits, and generally require little persuasion to continue their donations. However, there is always some attrition of donors, as well as a desire on the part of the Field Investigator to obtain fresh donors with high LNI's. On most of the Field Investigator's trips one day is occupied in visiting villages in order to persuade convalescents to join the program, once six months have elapsed since their illness.

Lassa fever cases

Both serological and virological techniques are used in the diagnosis of LF. The serological diagnosis of LF depends upon seroconversion or upon a four-fold rise in LV antibodies in serial specimens as determined by the IFA technique. In some cases the initial specimen is obtained from the patient late in the course of illness, when the IFA titer is already high. In others, only one specimen is obtained for a number of reasons, including death of the patient, and comparison of serum titers is not possible. If a single serum only is obtained, and if the IFA titer is 1:64 or higher, the patient is classified as Possible LF (PLF).

As might be expected, when virus isolation is performed the diagnosis of LF is made in patients among whom it is missed if only serological criteria are used for the diagnosis (1, 8). During the past year virus isolation was not attempted in most patients. Thus, the incidence of LF this year cannot be compared easily with the results of former years when virus isolation was carried out.

Table 2 in the Appendix summarizes the results of tests of febrile patients in CLH, PH, Kolahun Hospital (KH), the hospital and Rehabilitation Center at Ganta and at ELWA hospital near Monrovia.

With the placing of a solar-powered refrigerator-freezer at Kolahun testing of patients at KH became possible. In one of 10 febrile patients tested there the IFA titer of a single specimen was 1:512, almost certainly indicative of current LF; in accordance with our criteria the case was diagnosed as PLF. This is the first case of LF or PLF for KH, though serosurveys have indicated considerable LV activity in surrounding villages.

A small group of sera from ELWA hospital, near the Liberian coast, was tested, and in one patient seroconversion demonstrated LF. This is the first proved case of LF in that institution though a number of patients in the past have proved to have LV IFA at low titer. It is not clear where the patient acquired her infection, whether in the environs of Monrovia near the coast or during the course of travel into the interior.

The physicians at PH believe on clinical observation that there was a sudden rise in the number of LF cases in early 1987 and that cases tended to be more severe. Furthermore, in early 1988 two physicians on the PH staff acquired LF, presumably in the course of patient care. One may speculate that during this period a LV serotype other than that which has been common at PH caused a more severe and perhaps more contagious illness than the usual in the hospital. Without the more complete identifiction of cases that virus isolation attempts afford, it is difficult to confirm their impressions. It would be appropriate to attempt to characterize one or more isolates from this period to determine whether a variant of LV more virulent and contagious than others was active in the PH catchment area.

Clinical observations at CLH have revealed a number of icteric patients from whom LV was isolated. Studies are in progress to determine whether there is an icterogenic LV variant active in the area. Lassa virus does cause liver disease, but jaundice is not common; previously LV was isolated by the Centers for Disease Control from one case of icteric hepatitis in an expatriate nurse in Benin (Unpublished observation).

Passive immunotherapy

At PH there is a standing rule that if the clinical diagnosis of LF is made the patient is to receive an infusion of LFIP. The two physicians mentioned above who acquired LF each received two units of LFIP. Both recovered, and seronconversion confirmed the clinical diagnosis in both. Without virus isolation, however, it is unclear what proportion of the LFIP recipients do in fact have LF. Furthermore, LNI's of donor plasma have not been completed for many of the units. It is expected that during the course of the next several weeks neutralizing antibodies of the plasma units will be determined in order to calculate their LNI's.

However, the question as to accuracy of diagnosis will persist even after the potency of the plasma has been determined. The large

volume of cases and the various demands upon the schedule of the containment laboratory in which LV is isolated preclude virus isolation in all suspected cases of LF. The antigen capture ELISA will identify the presence of antigen and demonstrate the presence of virus. During the past year variations of technique have been tested both at the laboratory in Liberia and at USAMRIID in order that the sensitivity and specificity be established for use in the field.

In the absence of other therapy the use of LFIP does appear reasonable in an area endemic for LF.

Conclusion

Continuing investigations into LF in Liberia during the past year have suggested limitations of the present program and several promising avenues of future research. The site visit by Dr. Peter Jahrling helped bring them into focus.

Appropriate evaluation of therapy is limited by difficulties in maintaining temperatures low enough to permit reliable determination of virus titers, the criterion for measuring the efficacy of whatever treatment is tried. Measures to ensure adequately low temperatures for the storing of specimens must be provided in the field.

Though ribavirin has been demonstrated to be effective therapy for LF (9, 10), it is not successful in the treatment of patients who are highly viremic either because of overwhelming infection, highly virulent serotypes, or rising virus concentrations with the duration of infection. Anecdotal reports suggest that immunotherapy is also effective (11, 12). However, variable neutralilzing antibody titers in plasma units make evaluation of therapy difficult. The use of Lassa Fever Immune Globulin, proposed by Dr. Jahrling, would permit the evaluation of standard doses of a relatively uniform therapeutic modality.

A method of laboratory diagnosis of LF suitable for field installations is urgently needed. Without such a method the diagnosis and management of LF will remain essentially a research exercise. The ELISA will be a major forward step in making the diagnosis of LF possible in many hospitals in Africa; even simpler techniques will be needed if the disease is to be recognized in the smaller "bush" hospitals where most cases are likely to be seen.

Finally, further studies into the nature of the virus or viruses of LF are needed. Clinical experience suggests that there are variants of LV which have not been well characterized. For example, the experience in Liberia during the period included in this report showed variation in frequency and possibly virulence even in locations where the disease had already become familiar to medical and nursing staff. Basic research is required to elucidate the causes for syndromes not yet commonly associated with LV infections but which present themselves to the clinician.

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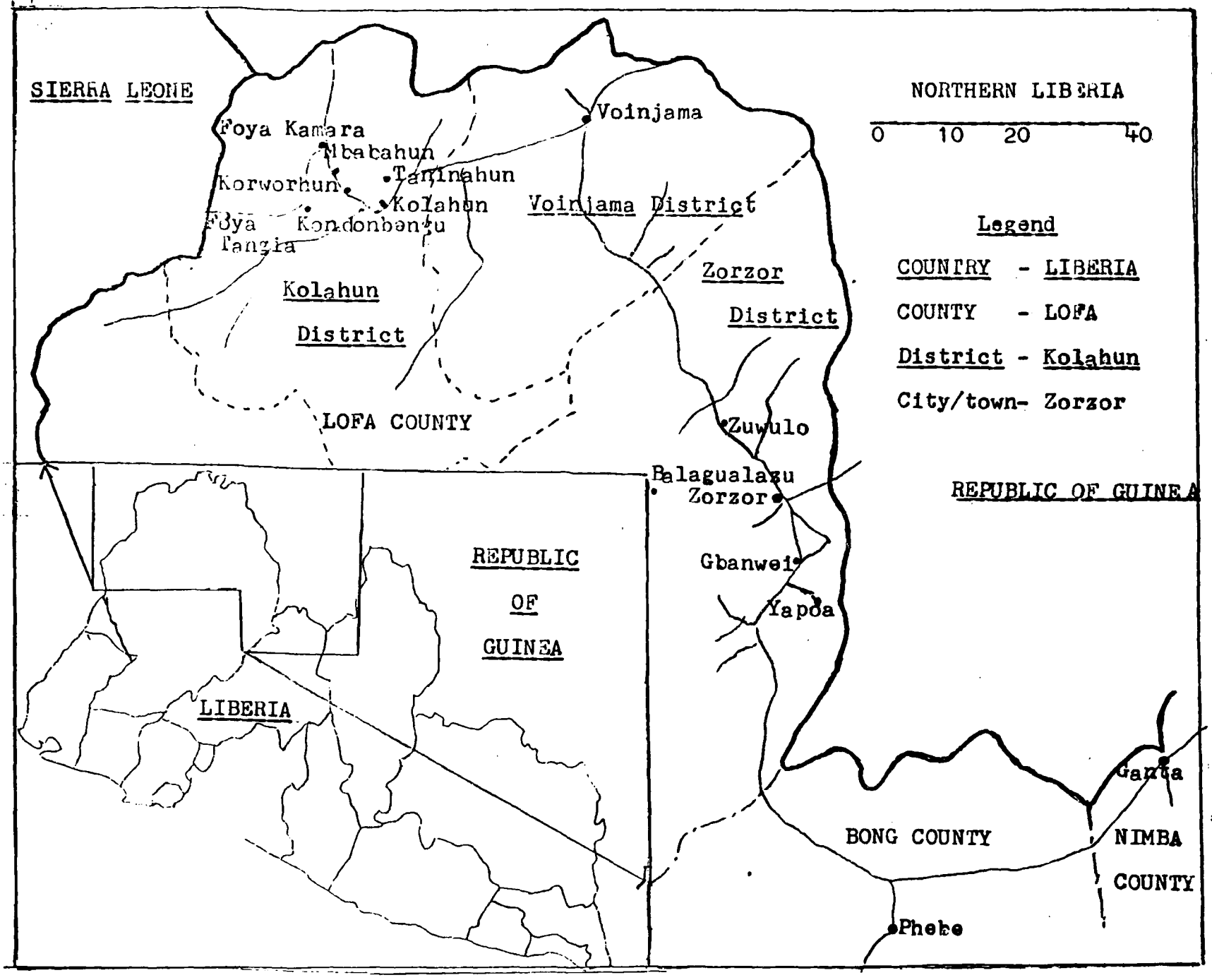
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Balagualazu
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BONG COUNTY
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Phebe

Appendix: Tables.

Table 1. Lassa fever immune plasma units collected July 1987 - June 1988.

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
DaBa	11/82	5/12/86	16	1.6	2.2		
		4/29/87					2
		7/18/87				2	2
		11/30/87				2	
		2/23/88				2	
		4/13/88	64			2	2
		5/7/88					2
		6/8/88	32			2	2
GoCo	3/85	4/23/86	32	2.2	2.2		
		3/1/88				2	
		6/15/88	32			2	2
OlCo	4/85	3/1/88				2	
		12/3/87				2	
		4/15/88				2	1
		6/16/88	32			2	2
JaDa		4/16/88				2	1
		6/15/88	8			2	
DaDo	4/77	9/9/86		0.5			
		7/18/87				2	
		10/24/87				2	
		11/30/87				2	
		2/22/88				2	
		4/11/88				2	2
		6/7/88	16			2	2
JoFa		11/10/87				2	
		4/15/88				2	1
		6/15/88	4			2	
KeFlz	1983	9/11/86		1.3			
		7/16/87				2	2
		10/23/87				2	2
		12/3/87				2	
		2/23/88				2	1
KeFlp		4/16/88				2	2
		6/16/88	-			2	

Table 1 (cont.)

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
LoFl	1/82	5/14/86	8	1.6	1.9		
		11/30/87				2	
		5/7/88					2
		6/8/88	8			2	2
WiFo		10/24/87				2	
JoGa		9/10/86		0.8			
		7/16/87				2	2
		11/11/87				2	
		12/15/87				2	
		2/23/88				2	2
		4/13/88				2	2
		6/8/88	32			2	2
FaHo		10/24/87				2	1
JoHo	3/85	7/17/87				2	
		10/23/87				2	
		12/1/87				2	
		2/23/88				2	1
		4/11/88				2	2
		5/7/88	8			2	1
		6/7/88				2	2
DaJa	10/84	9/11/86		0.4			
		7/17/87				2	
		10/22/87				2	
		11/30/87				2	
		2/22/88				2	2
IrJo	02/83	9/11/86		2.2			
		7/17/87				2	2
		10/22/87				2	2
		12/2/87				2	
BoKa	10/82	9/11/86		1.2			
		7/18/87				2	2
		10/22/87				2	2
		11/30/87				2	
		2/24/88				2	1
		4/12/88				2	2
		5/7/88				2	2
		6/8/88	16			2	2
GoKa		2/23/88				2	
		4/12/88				2	

Table 1 (cont.)

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
JohKe	3/84	9/10/86	8	2.1			
		7/17/87				2	2
		10/24/87				2	1
MuKe	9/84	6.24.86	-	0.3			
		3/1/88				2	
		4/15/88				2	1
EsKn		9/11/86		0.4			
		7/16/87				1	
		10/24/87				2	
		12/2/87				2	
		2/23/88				2	
		4/13/88				2	2
		6/9/88				2	2
AKo		6/15/88	4			2	
JoKo		4/224/84	4	0.3	0.4		
		11/11/87				2	
		3/1/88				2	
		4/15/88				2	1
GaKoII	7/83	9/11/86		0.3			
		10/22/87				2	
		2/22/88				2	
		4/13/88				2	2
GaKon		2/23/88				2	1
		4/12/88				2	1
		5/7/88				2	2
YaKo	10/81	6/25/86	8	1.4			
		7/18/87				2	2
		10/24/87				2	2
		12/2/87				2	
		4/24/88				2	
DaKo	10/81	9/11/86		3.9+			
		7/16/87				2	2
		11/30/87				2	
		2/22/88				2	
		4/11/88				2	2
		5/7/88				2	2
		6/7/88	64			2	2

Table 1 (cont.)

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
KeKo	7/82	10/8/85	16	1.3	1.8		
		7/18/87				2	2
		12/1/87				2	
		2/23/88				2	1
		4/12/88				2	2
		6/8/88				2	2
SoKw		6/16/88	8			2	
		11/11/87				2	
KaMa	03/83	9/10/86		1.4			
		7/17/87				2	?
		12/1/87				2	
KoMa		9/9/86		0.4			
		12/1/87				2	
		4/12/88				2	1
		5/7/88				2	2
		6/7/88	16			2	2
NoMa	11/82	6/25/8[illegible]	16	3.1+			
		7/16/87				2	2
		10/23/87				2	2
		12/2/87				2	
		2/23/88				2	
		5/7/88				2	2
		6/9/887	64			2	2
JoMe		12/11/87				2	
		3/1/88				2	
		4/15/88				2	2
		6/15/88	4			2	
JoMi		11/10/87				2	
		3/1/88				2	1
		4/15/88				2	2
		6/5/88	16			2	
JaMo	?	5/12/86	8	0.3	0.6		
		11/30/87				2	
		10/23/87				2	
		2/23/88				2	1
		4/11/88				2	1
		6/7/88				2	2
DaMu		3/2/88				2	
		4/15/88				2	1
		6/16/88	-			2	

Table 1 (cont.)

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
SiMu		10/24/87				2	
SaPa		11/10/87				2	
		4/15/88				2	
		6/16/88	4			2	
ErRi	6/84	6/25/86	128	1.7			
		10/23/87				2	2
		12/2/87				2	
		2/23/88				2	1
		4/11/88				2	1
		5/7/88				2	2
		6/9/88	16			2	2
DaSu	01/83	9/10/86		0.5			
		11/30/87				2	
		2/23/88				2	1
		6/8/88				2	2
HeSu		3/2/88				2	1
YaTa	9/82	8/8/85	8	0.6	1.4		
		5/7/88				2	2
JoTo		6/22/87	32				
		11/10/87				2	
		4/15/88				2	1
BeTo	2/84	6/25/86	128	1.8			
		7/18/87				2	2
		10/23/87				2	2
		12/1/87				2	
		4/11/88				2	2
		5/6/88				2	2
		6/8/88	64			2	2
DaTo@	03/83	12/3/85	8	4.1+			
		7/16/87				2	
		10/22/87	16			2	
NoTo	1984	9/12/86		2.2			
		12/1/87				2	
		2/22/88				2	1
		6/7/88				2	2
GeTu		6/23/87	64				
		11/1/87				1	

Table 1 (cont.)

Donor	Date of illness	Date of donation	IFA titer*	LNI# Jos	LNI# Mac	Number of units Collected	Number of units USAMRIID**
YaVa	02/82	5/13/86	8	1.0	0.8		
		7/16/87				2	2
		10/23/87				2	2
		12/1/87				2	
		4/11/88				2	1
		5/6/88				2	2
		6/9/88	32			2	2
BeVa	8/78	3/19/86		1.0	0.8		
		2/22/88				2	
		4/12/88					
		6/8/88	8			2	2
KlVe	07/83	6/25/86	32	0.7			
		7/18/87				2	2
		10/23/87				2	
		12/1/87				2	
		4/12/88				2	2
		6/7/88	8			2	
RaVe	12/82	5/13/86		0.4	0.2		
		7/17/87				2	
		4/12/88				2	2
		6/8/88	16			2	
YaWa		10/24/87				2	
JoWo		2/24/88				2	1
		4/13/66				2	2
		6/9/88	-			2	2
MoWo	04/77	9/10/86		2.2			
		12/2/87				2	
		2/22/88				2	1
		5/7/88				2	2
		6/8/88	32			2	2
MaZa	07/82	5/14/86	16	0.9	0.7		
		6/8/88	64			2	2
	Total					358	180

NOTES:

* Expressed as reciprocals of indirect fluorescent antibody titers. Tests performed at the LIBR. Reactivity of reagent varies

Table 1 (conc.)

from batch to batch, and comparisons of values must be made with caution. Not all tests were completed at the time of preparation of the Annual Summary Report.

Log Neutralization Index: Josiah (Jos) and Macenta (Mac) strains of Lassa virus used as reagents. Tests performed at USAMRIID; not all completed at the time of the preparation of the Annual Report. If no tests have been performed to date on specimens submitted during the past year, the most recent previous determination is included, whenever possible showing LNI's to both strains.

** In general, specimens were forwarded to USAMRIID which showed an LNI of at least 0.3. Some specimens forwarded before LNI had been determined.

@ HBsAg positive.

Table 2. Incidence of Lassa Fever among febrile patients in selected hospitals in Liberia, May 1986 - June 15, 1988.

Hospital	No. tested	Lassa Fever			Possible LF (High IFA titers	Total, LF and possible LF(Rate)	Other IFA pos.
		Virus Isolation	Seroconversion	Total (Rate)			
a. Curran							
5/1/86-9/30/86#	52	6	3	9 (0.173)	0	9 (0.173)	
10/1/86-12/31/87	23	*	3	3 (0.130)	0	3 (0.130)	
1/1/87-6/15/88#	230	*	20	20 (0.084)	11	31 (0.130)	6
Total	305	6	26	32 (0.108)	11	43 (0.141)	6
b. Phebe							
5/1/86-9/30/86	62	8		8 (0.129)		8 (0.129)	1
10/1/87-12/31/86	36	*			3	3	2
1/1/87-6/15/88	281	*	19	19 (0.066)	22	41 (0.146)	11
Total,	377	8	19	27 (0.138)	25	52 (0.072)	14
c.Kolahun 12/87-2/88	10				1	1(0.10)	1
d.ELWA	4		1	1(0.25)		1(0.25)	
e.Ganta	7				1	1(0.14)	

* Virus isolation being performed, but not yet completed.
\# Data incomplete

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